

MIL-T-87980(84)
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MILITARY SPECIFICATION

TRUCK, SEWER AND PIPE CLEANER, HIGH PRESSURE
WATER JET TYPE, AND MANHOLE VACUUM CLEANER

This specification is approved for use within Code 84, Department of the Air Force, and is available for use by all departments and agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers a truck mounted unit for sewer and pipe cleaning using high pressure water.

2. APPLICABLE DOCUMENTS

2.1 Government Documents.

2.1.1 Specifications, Standards, and Handbooks. The following specifications, standards, and handbooks form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONSFederal

W-B-131 Battery, Storage: Vehicular, Ignition, Lighting and Starting

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: WR-ALC/MMEDTA, Robins AFB, GA31098-5990 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

"AMSC N/A"

FSC 2320

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STANDARDS

Federal

FED-STD-595 Colors

Military

MIL-STD-130 Identification Markings of US Military Property

MIL-STD-1223 Administrative Wheeled Vehicles Treatment, Painting, Rust-proofing, Undercoating, Identification Marking, Data Plates and Warranty Notice Standards

MS-51317 Light, Warning, Vehicular, Rotating, D.C.

2.2 Other Publications. The following documents from a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted shall be those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS shall be the issue of the non-government documents which is current on the date of the solicitation.

DEPARTMENT OF TRANSPORTATION (DOT)
Federal Motor Carrier Safety Regulations
Federal Motor Vehicle Safety Standards

(Application for copies should be addressed to the Department of Transportation, Federal Highway Administration, Washington, D.C. 20591).

ENVIRONMENTAL PROTECTION AGENCY (EPA)
Control of Air Pollution From New Motor Vehicles and New Motor Vehicle Engines
Noise Emission Standards for Transportation Equipment - Medium and Heavy Trucks

(Application for copies should reference the Code of Federal Regulations 40 CFR and the Federal Register and should be addressed to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402)

SOCIETY OF AUTOMOTIVE ENGINEERS, INC. (SAE)
SAE Standards and Recommended Practices

J245 Engine Rating Code - Spark Ignition
J350 Spark Arrester Test Procedure for Medium Size Engines
J534 Lubrication Fittings
J537 Storage Batteries
J551 Limits and Methods of Measurement of Radio Interference Characteristics of Vehicles and Devices (20-1000 MHz)
J588 Turn Signal Lamps
J589 Turn Signal Switch

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J682	Rear Wheel Splash and Stone Throw Protection
J683	Tire Chain Clearance - Trucks, Buses, and Combinations of Vehicles
J688	Truck Ability Prediction Procedure
J844	Nonmetallic Air Brake System Tubing
J1349	Engine Power Test Code - Spark Ignition and Diesel

(Application for copies should be addressed to the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096).

THE TIRE AND RIM ASSOCIATION, INC.
Yearbook

(Application for copies should be addressed to the Tire and Rim Association, Inc., 3200 W. Market Street, Akron OH 44313).

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies).

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, and specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulation unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Standard vehicle and accessories. The vehicle, components, assemblies, and accessories to be delivered under the contract shall be standard commercial items, which meet or exceed the requirements of this specification. All chassis items shall be as represented and rated in the chassis manufacturer's technical data, and special bodies or mounted equipment shall be as represented and rated in the body and equipment manufacturer's technical data. Technical data shall be limited to specifications and technical material, identical to that furnished to the authorized company representatives for selection of vehicle models and components, and shall be on file in the engineering offices of the procuring activity, prior to delivery of the items. The supplier shall furnish a complete sewer cleaning vehicle for preproduction inspection in accordance with Sections 4 and 6. The chassis model furnished shall be not older than the chassis manufacturer's current model on the date of invitation for bids.

3.1.1 Special requirements. In addition to standard vehicle and components, the vehicle shall be furnished with special equipment as specified herein.

3.1.1.1 Treatment and painting. The vehicle shall be treated and painted in accordance with MIL-STD-1223. Unless otherwise specified (see 6.2), the

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vehicle shall be gloss yellow color 13538 of FED-STD-595.

3.1.1.2 Markings, data plates, warranty notices, etc. Identification marking, data plates, and warranty notices shall be in accordance with MIL-STD-1223.

3.1.1.3 Rustproofing. When specified (see 6.2), the vehicle shall be rustproofed in accordance with MIL-STD-1223. Unless otherwise specified, the vehicle shall be rustproofed in accordance with the manufacturer's standard commercial practice.

3.1.1.4 Undercoating. When specified (see 6.2), the vehicle shall be undercoated in accordance with MIL-STD-1223.

3.1.1.5 Drain plugs. Drain plugs installed in rear axles shall be of the permanent magnet type.

3.1.1.6 Coolant system and indicators. The coolant system shall include a deaeration system, a surge tank or a coolant recovery reservoir of not less than two quart capacity. A low coolant level or high coolant temperature alarm buzzer and/or red indicator warning light shall be provided on the dash instrument panel. On tilt cab models, a radiator servicing access door shall be provided to allow verification of coolant level. The manufacturer's heavy duty cooling system shall be supplied.

3.1.1.7 Wood treatment. As specified (see 6.2), any wood surfaces shall be treated in accordance with MIL-STD-1223.

3.1.1.8 Towing devices. Not less than two hooks, loops, pins, or a single, center mounted towing eye for towing the vehicle shall be furnished on front or rear of the vehicle.

3.1.1.9 Wheel splash and stone throw protection. All tilt cabs shall have rubber mud flaps to the rear of the front wheels. All splash shield and mud flap installations, front and rear, shall conform to the rear wheel splash and stone throw protection provisions of SAE J682. The quarter fenders on tractors need extend down only to the height of the centerline of the rear axle.

3.1.2 Truck mounted equipment. Sewer and pipe cleaner shall be mounted on a commercial truck. The mounted equipment shall include, but not limited to, a water tank, water pump, hose reel, high pressure hose, water nozzle, necessary piping, fittings, controls, hydraulic system, and hand held water hose, nozzle and accessories required for jetting operation and all necessary piping, hose and fittings; and, additional accessories required to insure the removal of water and solids from the manhole, depositing same in the debris tank, and provisions for draining the water from the tank. Storage compartments shall be provided for all tools and equipment necessary for operation. The compartments shall be easily accessible without the use of additional equipment. Compartment doors shall be equipped with hinges and recessed latches. All compartment latches shall be the keyless type. Compartment doors shall be equipped with device to hold the doors in the open position.

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3.1.3 Reliability. The sewer cleaning vehicle and accessories shall be essentially the current standard product of a well-established manufacturer, differing only in respects necessary to meet the requirements of this specification. The item shall be of proven design having been used by industry. Supplier shall have spare parts and components for repairs readily available.

3.1.4 Material. Material shall be as specified herein. Material not definitely specified shall be of the same quality used for this purpose in commercial practice, free from all defects that affect serviceability and appearance of the finished product.

3.1.5 Construction. Where no specific construction requirements are specified herein, the manufacturer's commercial standard shall apply. All parts, components, and attachments shall be identical for each sewer cleaning vehicle furnished under any specific contract. No deviations will be accepted without prior written approval of the contracting officer.

3.1.6 Safety. All rotating or reciprocating parts and all parts subject to high operational temperatures that are so located as to be or become a hazard to the operating or attending personnel, shall be guarded, or insulated to the extent necessary to eliminate the hazard. The principal platform walking surfaces shall be of an antiskid type. Ladders, steps, and handholds shall be provided in such quantity and size on the sides of the tank that access to the mounted equipment and operating controls shall be unhampered and non-hazardous.

3.1.7 Maintainability. The component and accessory location and installation, shall permit ready accessibility to all items requiring periodic maintenance conventional general purpose tools associated with equipment of this nature. The replacement and adjustment of components and accessories shall be accomplished with minimum disturbance to other elements of the vehicle.

3.2 General design.

3.2.1 Federal motor vehicle safety standards. The vehicle and furnished accessories shall comply with all Federal Motor Vehicle Safety Standards in effect on the date of manufacture.

3.2.2 Air pollution control. Vehicle shall comply with the Environmental Protection Agency Regulations governing Control of Air Pollution from New Motor Vehicles and New Motor Vehicle Engines in effect on the date of manufacture. In addition, vehicles destined for California shall conform to regulations governing air pollution control in effect on the date of manufacture.

3.2.3 Sound level. The interior sound level shall conform to Federal Motor Carrier Safety Regulation 393.94. The vehicle exterior sound level shall conform to the Environmental Protection Agency Noise Emission Standards for Transportation Equipment, Medium and Heavy Trucks.

3.2.4 Curb weight. Curb weight shall include weight of chassis, and cab with

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all attachments, accessories and equipment, body, full complement of fuel lubricants, and coolant.

3.2.5 Gross vehicle weight. Gross vehicle weight (GVW) shall consist of curb weight, operator (weight computed at 175 pounds), and a payload. The payload shall consist of the water required to fill the water tank (see 3.5.2.1).

3.2.6 Weight distribution. The distribution of gross vehicle weight for the purpose of establishing suspension, axle and tire capacities shall be determined with the tanks filled to their normal capacity (water and/or solids).

3.2.7 Ratings. All chassis components (axles, frames, tires and rims, etc.) will have a rating equal to or greater than the imposed load on the component.

3.3 Performance.

3.3.1 Speeds and gradeability. High and low speed requirements shall be met with truck loaded to specified GVW (see 3.2.5).

3.3.1.1 High speed gradeability. The vehicle shall ascend 0.5 percent continuous grades at 50 miles per hour (MPH). Gradeability requirements shall be met with the main transmission in direct drive and when multispeed axle or auxiliary transmission is furnished, with the axle and auxiliary transmission in highspeed range. Gradeability shall be verified with calculations in accordance with SAE J688.

3.3.1.2 Low speed. Low speed shall be calculated with the engine operating at not less than 35 percent of recommended governed speed, and shall provide not more than the 3.0 mph.

3.3.1.3 Maximum geared speed. The maximum speed at engine governed speed shall be not less than 60 mph for gasoline engine driven vehicles and not less than 55 mph for diesel engine driven vehicles. Conformance to geared speeds specified shall be determined by calculating in accordance with the following formula:

Maximum geared speed (mph) equal
$$\frac{\text{governed speed (rpm)}}{\text{total gear reduction} \times \text{tire factor}}$$

3.3.2 Service brakes. Service brakes shall control and hold the vehicle, when loaded to its specified gross weight, on a 30 percent grade. The service brakes shall stop the vehicle within the stopping distance requirements of Federal Motor Vehicle Safety Standard No. 121, under all conditions of loading, up to specified GVW with the center of gravity of the payload located as high as 1/2 of the body inside height for vehicles with body load space.

3.4 Chassis components.

3.4.1 Engine. The engine shall be the chassis manufacturer's standard, or

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optional engine for the commercial model truck which meets or exceeds the requirements of this specification.

3.4.1.1 Diesel engine. The vehicle shall be equipped with a liquid cooled, compression ignition, two-stroke or four-stroke cycle diesel engine, with not less than six cylinders. Engine net horsepower figures used in performance prediction calculations shall be determined in accordance with SAE J1349. A fan clutch to automatically reduce fan speed, when not required for engine cooling, shall be provided.

3.4.1.2 Oil filter. A full-flow type oil filter shall be furnished.

3.4.1.3 Governor. An engine governor shall be furnished and set and sealed to limit engine manufacturer's maximum recommended operating speed.

3.4.1.4 Coolant temperature control. Thermostatic control of engine coolant temperature shall be provided. On diesel engine driven vehicles, control shall include partial thermostatic control of coolant flow through the radiator and thermostatically controlled radiator shutters or complete thermostatic control of all coolant flow through the radiator.

3.4.1.5 Winterization. When specified (see 6.2), coolant, engine oil, and battery heaters shall be provided. Heaters shall operate on 110-volt alternating current (AC), and shall be wired through a junction block to a single, three-pronged (male), weatherproof, slave receptacle for receiving external power and grounding vehicle. A three-wire connecting cable, 25 feet long and of adequate line capacity to supply power for all heater units simultaneously, shall be furnished. Connecting cable shall include a matching female connector at the vehicle end and a standard, weatherproof, three-prong (two power plus one ground) male connector at the other end. Electrical apparatus shall conform to Federal Motor Carrier Safety Regulation 393.77(c)(7). Electrical insulation of connecting cable shall withstand normal operating stresses in low ambient air temperature (down to minus 60°F) without cracking or loss of dielectric capacity. All heater lead wires shall be installed without interfering with vehicle component operations, and without loose, excess wire of the cable shall be provided in the vehicle cab. Heaters shall be furnished as follows:

(a) Coolant heater, 1500-watt minimum rating, shall be installed in the engine block or lower, coolant, inlet hose. A coolant circulating pump, driven by a 110-volt AC motor, shall be provided. Engine thermostat with an operating range of 170° to 195°F shall be installed.

(b) Immersion type engine oil heater, 300-watt minimum rating, with 170° to 195°F thermostat, shall be installed in oil pan through any convenient opening.

(c) Battery heater shall have a capacity adequate to maintain the battery electrolyte at a temperature of not less than 10°F during vehicle exposure in ambient air temperatures as low as minus 60°F, and shall embody a thermostat

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to limit the temperature of the electrolyte to not more than 80°F.

3.4.2 Electrical systems. The electrical system shall be in accordance with Federal Motor Carrier Safety Regulations 393.27 through 393.31 and 393.33.

3.4.2.1 Starting system (diesel). For diesel engine driven vehicles, a 12 or 24-volt direct current (DC) starting system with 12-volt lighting system and with not less than a 60 ampere alternator shall be furnished. Engine starting equipment shall include an ether starting system or glow plug. If an ether system is furnished in lieu of a glow plug, it shall be of the measured shot type, controlled from the driver's compartment, with a reservoir of not less than 12 fluid ounces, and shall be inoperative with the engine warm.

3.4.2.2 Lighting. All vehicle lights, reflectors, and wiring shall be as specified herein and shall be in conformance with Federal Motor Carrier Safety Regulations 393.12, 393.13, 393.19, 393.20 and 393.22 through 393.26(d). Lights and reflectors shall not be mounted on vertical surface of rub rails or mounted on vehicle bumpers.

3.4.2.3 Turn signals. Turn signal lamps shall conform to SAE J589. Operating units shall conform to SAE J589, Class A, and shall be mounted on the steering column. Vehicle shall be provided with double-faced front signal units and with single-faced rear signal units installed in accordance with SAE J588, except that turn signals shall not be mounted on engine compartment hood. Turnsignal operating units shall have visible and audible flash indicator.

3.4.2.4 Warning light. An amber rotating, vehicular warning light conforming to MS 51217-4 shall be furnished. The light shall be mounted with reinforcement on vehicle centerline for 360° visibility. Warning light shall be operated by means of a separate switch with red indicator light marked to indicate function of switch.

3.4.2.5 Batteries. Each battery shall be of 12-volt potential. Reserve capacity and cold cranking ratings shall be measured in accordance with SAE J537. The batteries shall be of the maintenance free type having the maintenance free characteristics in W-B-131.

3.4.2.6 Radio interference suppression. The vehicle shall be suppressed to limit electromagnetic radiation in accordance with SAE J551.

3.4.3 Fuel system. The fuel system shall conform to Federal Motor Carrier Safety Regulations 393.65 and 393.67.

3.4.3.1 Air cleaner. An air cleaner shall be furnished. When equipped with an oil bath type, oil capacity shall be not less than one quart.

3.4.3.2 Fuel tank(s). Fuel tank(s) shall be not less than 43 gallons total capacity. When more than one tank is furnished on a gasoline engine driven vehicle, a selector valve connecting either tank to engine fuel intake shall be

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provided. When more than one tank is furnished, means shall be provided to assure equalized fuel level in both tanks.

3.4.4 Exhaust system. The exhaust system shall conform to Federal Motor Carrier Safety Regulation 393.83. Exhaust mufflers, when stacked, shall be furnished with a heat shield and a hinged rain cap. A spark arrester having an 80 percent efficiency when tested in with SAE J350 shall be furnished on all vehicles.

3.4.5 Transmission. An automatic, or semi-automatic transmission shall be furnished. Input torque capacity of the transmission shall be at least equal to the maximum torque delivered by the engine. Gear ratios in transmission and axles shall be matched to provide a progressive shifting pattern throughout the complete range and shall provide required vehicle performance (see 3.3). The transmission shall be of the fixed ratio or infinitely variable type and shall provide continuous drive. The fixed ratio type shall include a hydraulic torque converter and not less than four forward gear ratios. Normal driving range selector position shall provide not less than three gear ratios without movement of the selector. The infinitely variable type shall include a hydro-tatic start-up mode and a hydromechanical full-speed mode with a control system to shift power flow from one mode to the other automatically. The driving range selector shall provide a normal drive position and a second low speed, high power position. On both types of transmission a drive gear for the power take-off shall be provided. When a power take-off is used on the vehicle, a caution plate reading "DO NOT OPERATE VEHICLE AT HIGHWAY SPEEDS WITH POWER TAKE-OFF ENGAGED" shall be installed.

3.4.6 Drive line components. Drive line components shall be adequate to transmit the maximum delivered torque of the engine, as developed through the maximum gear train reduction.

3.4.7 Frame. The chassis frame shall be manufacturer's standard for the type and class vehicle furnished.

3.4.8 Suspension. The vehicle shall be equipped with a suspension system with components having the rated capacity at least equal to the load imposed on each member, measured at a ground, with the vehicle loaded to specified GVW. When spring capacity is rated at the spring pads, unsprung weight shall be deducted. Vehicles with a front axle rating of 12,000 pounds or less shall be equipped with hydraulic, double-acting shock absorbers at the front wheels.

3.4.9 Axles. Axle ratings shall be at least equal to the load imposed on each axle, measured at the ground, with the vehicle loaded to specified GVW.

3.4.10 Wheels, rims, tires and tubes. Except as specified herein, rim, tire, tube and flap ratings shall conform to Tire and Rim Association recommendations for the type and size of tires furnished.

3.4.10.1 Tires. Tires shall be steel belted radial or bias ply. Tires shall be tube or tubeless type with highway tread. Tires shall be of rated capacity

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at least equal to the load imposed on each tire, measured at each wheel at the ground, with vehicle loaded to specified GVW.

3.4.10.2 Inner tubes. For tube type tires, inner tubes shall be of heavy duty type, and shall be of proper size for tires furnished.

3.4.10.3 Carrier for spare tire assembly. When specified (see 6.2), a carrier for a spare wheel or rim and tire assembly shall be installed in a readily accessible location on the vehicle. Threaded fasteners, when used to secure the spare tire in a carrier, shall be constructed of or plated with corrosion-resistant material. The carrier design shall enable removal or mounting of spare wheel assembly using only tools specified in 3.4.16.2.

3.4.10.4 Spare wheel or rim. When specified (see 6.2), a spare wheel or rim shall be furnished. When a spare tire assembly is specified (see 3.4.10.5), a spare wheel or rim shall be furnished.

3.4.10.5 Spare tire assembly. When specified (see 6.2), a spare tire assembly shall be furnished. The spare tire assembly shall include an inflated spare tire mounted on the spare wheel or rim. The spare tire shall be of the same size, tread design and load range (ply rating) as the tires furnished on the vehicle.

3.4.11 Tire chain clearance. Tire chain clearance in accordance with SAE J683 shall be provided. Allowance for spring deflection shall be included.

3.4.12 Brakes. Brakes shall conform to Federal Motor Carrier Safety Regulations 393.40 through 393.42(b), 393.43, and 393.45 through 393.51; except in lieu of conformance to the brake performance requirements referenced therein (393.52), the vehicle shall conform to 3.3.2.

3.4.12.1 Service brakes. Vehicle shall be equipped with full-air brakes. The braking system, complete with all necessary components, shall include:

- (a) Air compressor, unloader-head-type, engine driven and engine lubricated, air or water cooled, and having a capacity of not less than 12 cubic feet per minute (cfm).
- (b) Air storage reservoir(s) with not less than 3,000 cubic inches; each tank equipped with automatic drain system, and with safety and check valves between compressor and last reservoir tank.
- (c) Foot control, suspended or treadle type.
- (d) Air control valves.
- (e) Air-pressure gage, visible to the driver.
- (f) Low-air-pressure warning, visible and audible.
- (g) Service brake stop lamp switch.
- (h) Alcohol aspirator with unbreakable transparent container.
- (i) Automatic moisture ejector.

3.4.13 Cab. The manufacturer may furnish any standard full width model cab. Cab doors shall be equipped with locks, operable from inside the cab through

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mechanical linkage, and with at least the curbside door equipped with external, key-operated lock. Drip rails shall be installed above the cab doors. The cab shall have upholstered, full-width, adjustable seat and back or individual, adjustable driver's seat and individual passenger seat. The color of the upholstery and the interior finish shall be compatible with the exterior color (see 3.1.1.1). White upholstery shall not be furnished. Safety grips shall be provided on each side of cab to assist personnel in entering and leaving the cab. Interior lighting shall be provided. Fastenings and two pair of seat belts shall be installed. For tilt type cabs, provisions to facilitate cleaning the windshield shall be provided by means of a bumper step, or bumper step cutouts, and a grab handle located under the windshield.

3.4.14 Steering. Power steering shall be furnished.

3.4.15 Windshield wipers and washers. The vehicle shall be equipped with dual windshield wipers and windshield washers. Windshield wipers shall be multi-speed type operated by air or electrical motor(s).

3.4.16 Bumpers. Unless bumper is an integral part of vehicle cab, a channel type front bumper shall be provided on vehicle.

3.4.16.1 Rear end protection. The rear end of vehicle shall be protected in accordance with Federal Motor Carrier Safety Regulation 393.86.

3.4.16.2 Tools. When specified (see 6.2), each vehicle shall be furnished with tools required for exchanging mounted tire assembly with the spare assembly and shall include at least a hydraulic jack, jack handle, and wheelnut wrench. The jack shall be of such closed height as to permit its location under axle, or other satisfactory lift point, at any wheel with the tire flat. The jack, without blocking, shall be capable of raising any wheel of loaded vehicle to a height adequate to permit removal and replacement of wheel and tire assembly.

3.4.16.3 Stowage space. Stowage space of sufficient size to accommodate a vehicle jack, hand tools, antiskid chains, and emergency reflective triangles shall be furnished for retaining equipment during vehicle operation. Stowage space for these tools may be furnished inside the cab. When stowage space for these tools is located outside of the cab, it shall be weatherproof and shall provide for locking with a padlock.

3.4.17 Heater and defroster. Hot water heater shall be provided. Heater shall have fresh air intakes. Discharge outlets shall be provided to direct heated air to floor and to defroster louvers. Heater shall be complete with blower and mounted controls convenient to the driver.

3.4.18 Controls and operating mechanisms. All controls and operating mechanisms shall be located for left-hand drive. Controls shall be complete and conveniently operable by the driver. Lever controls shall be designed and located to permit easy entrance and exit of operator to and from driver's com-

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partment. Instruments and controls shall be identified as to their function and installed in a manner to facilitate removal and servicing.

3.4.19 Accessories and equipment. Chassis equipment shall be complete with all accessories furnished as standard equipment by the manufacturer. The following minimum equipment shall be furnished:

- (a) Key-operated ignition switch.
- (b) Ammeter, charging indicator or voltmeter.
- (c) Fuel gage.
- (d) Oil pressure gage or indicator.
- (e) Engine temperature gage or indicator.
- (f) Speedometer with recording odometer.
- (g) Tachometer.
- (h) Ash receptacle.
- (i) Dual sunvisors.
- (j) Driver's compartment ventilator other than window.

3.4.20 Rearview mirrors. Outside rearview mirrors shall be mounted on each side of the cab. The mirrors shall be of the combination type having flat and convex areas. The flat portion shall have not less than 50 square inches of reflective area. The convex portion shall have not less than 20 square inches of reflective area.

3.4.21 Engine hour meter. An engine hour meter having a totalizing mechanism of not less than 9,999 hours shall be furnished for the chassis engine to register accurately the number of hours of operating time. The meter shall be of rugged construction to insure continuous trouble free performance under severe operating conditions. Engine hour meter shall be mounted on the cab instrument panel.

3.4.22 Back up alarm. Trucks shall be provided with an audible, pulsating, signaling device (electric or mechanical) to caution personnel when the vehicle is in reverse gear operation.

3.5 Truck mounted equipment. The vehicle shall be capable of high pressure cleaning (rodding) and manhole cleaning simultaneously. The standard accessories normally furnished commercially shall be furnished. This shall include, but shall not be limited to, sand traps necessary for pipe from six to twenty inches, grapple tongs, and handles necessary to set sandtraps.

3.5.1 Controls and control panel. All gages, switches, levers, and control valves necessary for the control of the operation shall be located so the operator may have control of the operation at all times. A fixed control panel shall be provided and shall contain, as a minimum, a choke, positive speed control, and ammeter, oil pressure and water temperature gage, and a combination ignition starter switch for the auxiliary engine, if used. The control panel shall be located in a position to provide operator ease of operation and protection from debris and moisture from the normal operation of the vehicle.

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The controls and electrical components of the truck mounted equipment shall be protected or resistant to moisture and debris from the operation of the equipment and environmental conditions.

3.5.1.1 Lubrication. Lubrication means shall be provided for all moving parts requiring lubrication. Lubrication fittings shall be in accordance with SAE J534. Pressure lubrication fittings shall not be used where normal lubricating pressure may damage grease seals or other parts.

3.5.1.2 Servicing and adjusting. Prior to acceptance of the vehicle by the Government inspector, contractor shall service and adjust each vehicle for operational use including at least the following: focusing of lights; adjustment of the engine, electrical and brake system; filling and charging of battery; alignment of front wheels, complete lubricating of chassis, engine and running gear, with grades of lubricants recommended for the ambient air temperature at the delivery point; servicing of cooling system with a solution of ethylene glycol and water in equal parts by volume; and servicing of windshield washer reservoir with water and appropriate additives.

3.5.1.3 Noise level. The noise level, measured at 25 feet, shall not exceed 85dBA.

3.5.1.4 Identification marking. A corrosion-resistant metal nameplate, permanently and legibly marked with the following information in accordance with MIL-STD-130 shall be securely attached to each vehicle:

Nomenclature
 Manufacturer's model number
 Manufacturer's serial number
 Special characteristics, HP, RPM, etc.
 Nation stock number
 Manufacturer's name
 Contract number
 Weight
 Height Width Length Cube
 Center of gravity
 US

3.5.2 High pressure cleaning system.

3.5.2.1 Tank. The water tank shall have a capacity of not less than 1,000 gallons. The bottom of the tank shall be contoured to provide a sediment collection sump. The tank shall have a drain at this point. The drain shall be controlled by a valve that provides a method to drain the tank and any sediments collected in the "sump" area. This valve shall be controlled from the side of the vehicle. The tank shall be of non-corrosion steel or be coated with a long life material to prevent corrosion of the tank. The tank shall be fitted with connections and necessary controls and hose for filling the tank from a standard fire hydrant. The fill point shall be on the curb side of the vehicle. The tank and vehicle shall be fitted with not less than two gages to

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determine the water level in the tank. One gage shall be located at the fill station and one at the operator's station during equipment operation. The tank shall be vented for fill and discharge. The fill shall be through an air gap anti-syphon system. The tank shall have a strainer to filter the water going to the pump.

3.5.2.2 Water pump. The water pump shall be a positive displacement type, rated for continuous duty at not less than 60 gallons per minute (GPM) and not less than 2000 pounds per square inch gage (PSIG) pressure. The pump shall have an enclosed crankcase with an oil bath lubrication. The location of the pump shall not hinder pump service.

3.5.2.3 Auxiliary engine. An auxiliary engine may be used to operate the water pump and/or the vacuum pump. The engine shall be rated for continuous duty at the specified operating load. If provided, the engine shall be equipped with, but not limited to the following accessories:

- a. 12 volt charging system and starting system including the battery.
- b. Coolant and oil pressure gages.
- c. A vernier type throttle with positive-speed control, locking and quick release button or equal positive-speed throttle control.
- d. Oil filter (replacement cartridge type).
- e. Governor to prevent engine over-speeding.
- f. Automatic engine shut off with high temperature or low oil pressure.
- g. Engine intake air cleaner (dry type).
- h. Radio suppression in accordance with SAE J551.
- i. Engine hour meter.

3.5.2.4 Pump drive. The water pump shall be driven by the auxiliary engine or a power take-off. It shall be possible to operate the reel system without requiring the water pump to operate. It shall be possible to operate both systems at the same time and at maximum capacity. The drive mechanism shall have means for positive adjustment if belts and clutches are used to drive the water pump.

3.5.2.5 Hose reel. The vehicle shall have a reel to hold the high pressure hose. The reel shall have a capacity of not less than 750 feet of one (1) inch inside diameter high pressure hose. The construction of the reel shall be such that it can withstand the static and dynamic loads imposed by 750 feet of pressurized hose used during sewer cleaning. The sides of the reel shall afford protection to the operator in the event of hose failure. The reel shall be power driven in both directions. The reel shall be equipped with a manual means of emergency operation. The reel shall be designed so that it will not be necessary for the operator to guide the hose onto or off it. All drive chains, sprockets, etc., shall be provided with guards where necessary for the safety of the operator. Provisions shall be made to purge the hose of water after it is wound on the reel.

3.5.2.6 Footage counter. The vehicle shall have a footage counter to indicate the hose played out and recovered. The counter shall be capable of indicating

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not less than 600 feet in one foot increments.

3.5.2.7 Hose. Not less than four hundred feet of one inch ID, heavy-duty hose, shall be furnished and installed on the reel. The hose working pressure shall be not less than the maximum output pressure of the water pump. The cover of the hose shall be resistant to the scuffing, acids and greases normally encountered during the cleaning of a sewer line. The hose and fittings shall be capable of withstanding a minimum of 3,000 pound tensile load without damage. The length of the hose shall not change more than one percent as a result of changes in internal pressure in the range of 0 psi to maximum pressure at the inlet end of the hose. End of hose shall be provided with a fitting to accept lead hoses, nozzle and hose extension. The hose shall have a burst pressure of not less than 5,000 PSIG and a proof test of 2,500 PSIG. Each hose shall be hydrostatically tested to the proof test pressure.

3.5.2.7.1 Hose extension. A hundred foot high pressure hose extension shall be furnished. The hose shall have a fitting on each end that will mate with the hose fitting on the reel or shall accept the lead hose. The 100 foot hose extension shall be stored on the vehicle, or reel, when not in use.

3.5.2.8 Piping. All high pressure piping, both pipe and fittings, shall be designed for continuous operation at pressures up to the maximum output pressure of the water pump with adequate provision for over pressure. Piping shall have a safety factor of not less than 4 to 1. All suction and low pressure return lines may be of standard weight pipe and malleable fittings. Cast iron fittings shall not be used. The piping system shall be designed so as to facilitate complete draining of the entire system. The number of fittings and elbows shall be held to a minimum. The entire system shall be fitted with drains to drain the water for cold storage.

3.5.2.9 Nozzles. Stainless steel or hardened carbon steel cleaning nozzles shall be furnished.

3.5.2.9.1 Sand nozzle. A sand nozzle designed for use in sanitary and storm sewers with large build-up of sand and gravel shall be provided. The sand nozzle shall be a 15' to 18' radial nozzle with replaceable jets. The sand nozzle need not be steel.

3.5.2.9.2 Penetrator nozzle. A 30° to 35° nozzle designed for rapid penetration of blockage shall be provided.

3.5.2.9.3 Root cutter. A root cutting nozzle shall be supplied.

3.5.2.10 Hose guide shoe. A hose guide shoe with sectional (add-on type) handle shall be furnished. The design of the guide shoe shall facilitate entry of the nozzle and hose into sewers and shall protect the hose from the sharp ends of sewer tile.

3.5.2.11 High pressure cleaning gun. A high pressure general purpose cleaning gun shall be provided. The gun capacity shall be not less than 3-1/2 gpm with-

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in a pressure range of 200 psig up to the maximum output pressure of 800 psig. Cleaning gun shall provide discharge stream patterns ranging from a high to a low trajectory solid stream. A high pressure hose 25 feet in length with 1/2 inch inside diameter shall be provided for use with the gun. The hose shall be equipped with fittings for connection to the gun and to a high pressure water outlet. It shall not be possible to over pressure the high pressure cleaning gun with maximum engine RPM.

3.5.2.12 Hose repairing set. Hose repairing sets, a minimum of ten (10) sets, as normally supplied with the pipe and sewer cleaner, shall be furnished. The ten (10) sets shall consist of five (5) each hose mendors (repairing) and five (5) each terminal "hose end" hardware. The repairing set shall include any necessary tools required to repair the hose.

3.5.2.13 Spray bar. When specified (see 6.2), the truck shall be equipped with spray bar (or nozzles) for the discharge of water or insecticides. Means shall be provided for controlling the spray bar. These controls shall provide, but not be limited to, means to start, control volume and stop the flow to the spray bar.

3.5.3 Vacuum cleaning compartments. The manhole (catch basin) vacuum cleaner shall be comprised of, but not limited to, the following:

- a. Tank
- b. Pump
- c. Hoses
- d. Accessories

3.5.3.1 Tank. The tank shall have a minimum capacity of five (5) cu yards. Design of the tank shall include a minimum of internal baffles, if used. The tank shall be designed and constructed to insure strength and protection from corrosion. All seams and welds shall be leakproof. Additionally, configuration and placement of the baffles as well as design of the tank shall ensure continuous draining of the collected water when draining and cleaning. The tank shall have an inspection hatch, not less than 18 inches diameter, to permit visual observation of the inner portion of the tank if necessary for tank inspection. If inspection can be made through the discharge opening, and inspection hatch is not required. The tank shall have an indicator to indicate the level of solids and water in the tank if the amount of solids are not visible through inspection hatches. The hatch, if used, shall have a leak-proof, hinged cover equipped with a lift handle. All intake and outlet piping shall be of such design to allow water passage at a rate of not less than 250 gallons per minute (GPM), and shall not overflow the top tank hatch, if used when left open during the pick-up process. Piping shall allow the free passage of not less than four (4) inch spherical shaped solids through the system. Means shall be provided to ensure proper discharge of picked up debris and liquid. The tank shall be capable of being cleaned without the operator having to enter the tank, by water supplied from the high velocity sewer cleaner. The emptying system shall be designed in a manner to ensure complete removal of all debris deposited in the tank. The vehicle shall provide means for the storage

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of suction tube, hose, and other accessories.

3.5.3.2 Vacuum pump and engine. The engine cleaner shall be driven by the auxiliary engine or a power take-off unit. The pump section shall be capable of handling sludge, mud, gravel seepage, grit, sewage and slime. The pump, valves, hoses and receiving tank catch basin shall be compatible to the rough usage encountered in sewage manhole cleaning. The pump shall be capable of producing sufficient suction, in the pick-up system, to develop 90 inches of water. None of the picked up debris (50 micron or larger) and liquid shall pass through the pump. Any exhaust from the expended suction system shall be vented up and away from the operator. The suction pick-up system shall be so designed that the debris and liquid picked up will pass through sufficient baffles, separators, dust bins (chests) and other devices, if used in the system supplied, so that particles 50 microns and larger shall be separated from the suction system before it reaches the suction pump. It shall not be necessary to enter the tank or dust bins to clean the suction system, if used.

3.5.3.3 Suction tube and hose. The supplier shall furnish not less than 14 feet of pick-up tube. The pick-up tube shall be in not less than two (2) and not more than three (3) sections joined together with quick disconnects or one handle-operated-circular-overcenter-locking-clamp. The diameter of the pick-up tube and hose shall be not less than 6 inches. Sufficient hose and elbows shall be provided to position the pick-up tube in a 14 foot deep manhole and connect the pickup tube to the suction manifold. The hose and manifold connection shall have sufficient flexibility so that the pick-up tube can be positioned in a manhole by one man in front and to the right and left hand side of its mounting (120° minimum inclusive movement). The connection shall be such that, if disconnection is necessary for debris tank emptying, the disconnection shall be accomplished without the aid of tools. The joint shall be self-sealing, cleaning, and aligning during repositioning after tank dumping and cleaning. Power assist shall be provided so that one man can position the pick-up tube in a manhole (counterbalance is acceptable). In either case, the effort to position the pick-up tube shall not exceed 80 pounds of effort in any direction (x, y and z axis). The pick-up end of the tube shall be designed so that debris and liquid can enter the pick-up tube and be propelled by the suction to the debris tank.

3.5.3.4 Workmanship. The vehicle, including all parts and accessories, shall be constructed and finished in a thoroughly workmanlike manner. Particular attention shall be given to freedom from blemishes, defects, burrs and sharp edges, accuracy of dimensions, surface finish and radii or fillets, thoroughness of soldering, welding, brazing, painting, wiring and riveting, marking of parts and assemblies, alignment of parts and tightness or assembly fasteners, etc.

4. QUALITY ASSURANCE PROVISION.

4.1 Responsibility for inspection. Unless otherwise specified in the contract the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the

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supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and service conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of Sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.2 Classification of inspection. Inspection shall be classified as follows:

- a. Preproduction inspection.
- b. Quality conformation inspection.

4.2.1 Preproduction inspection. Preproduction inspection shall be applied to the preproduction sample submitted in accordance with 3.1. Failure of the preproduction sample to pass the examination or one or more preproduction tests shall be cause for rejection. Preproduction inspection shall consist of the examination in 4.3 and all tests in 4.4.

4.2.2 Quality conformance inspection. Quality conformance inspection shall be applied to each item prior to being offered for acceptance under the contract. Failure of the machine to pass the examination or one or more tests shall be cause for rejection.

Quality conformance inspection shall consist of the following:

- a. Examination (see 4.4).
- b. Inspection of preservation, packaging, packing and marking for shipment and storage (see 5.1).

4.3 Examination. Each sewer cleaning vehicle, including the preproduction sample, shall be examined for compliance with the requirements specified in Section 3 of this specification. Any redesign or modification of the supplier's standard product to comply with specified requirements, or any necessary redesign or modification following failure to meet specified requirements, shall receive particular attention for adequacy and suitability. This element of inspection shall encompass all visual examination and dimensional measurements. Noncompliance with any requirement or presence of one or more defects preventing or lessening maximum efficiency shall constitute cause for rejection.

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4.3.1 Radio frequency suppression verification. The vehicle manufacturer shall furnish a description of all interference suppression devices used to suppress vehicle electromagnetic radiation in accordance with SAE J551a. Data shall be sufficient for visual determination that all required suppression devices are installed on the vehicle.

4.4 Tests.

4.4.1 First production vehicle inspection. The first production vehicle produced under the contract shall be inspected by the contractor at his plant under the direction and in the presence of Government representatives. The purpose of the inspection shall be to determine conformity with the contract. The vehicle shall be functionally tested by operating the water and hydraulic systems for flow and pressure. The water nozzle shall be introduced into a pipe of not less than eight (8) inches in diameter. It shall be propelled, not less than 400 feet, through the pipe using the water pressure developed by the auxiliary engine and water pump. The footage counter shall be used to determine hose distance traveled through the pipe.

4.4.2 Suction test. With the vehicle positioned at a manhole or catch basin, not less than 14 feet deep, and all adjustments completed and supports in place, the test shall start. The manhole or catch basin may be simulated. One man shall position the pick-up tube and, by suction, pick-up debris and liquid until the holding tank is full. The liquid may be drained from time to time to provide storage room for the debris. During the tests the vehicle shall be used to clear storage room for the debris. During the tests the vehicle shall be used to clear a flooded manhole of four (4) feet of standing water and debris. The flooded manhole shall be cleared in not more than five (5) minutes. In a simulated sewer cleaning test the pick-up tube shall be positioned as though being used with a high pressure water cleaning system. The pick-up tube shall be used to pick-up debris and water that would be washed into the manhole during a sewer cleaning. The debris shall be sand, bottles, cans and rocks. The rock shall start as sand size and vary up to rock that cannot be sucked up by a suction of 90 inches of water. The debris shall include not less than two (2) cubic yards of sand, three (3) dozen water filled cans (soft drink size), two (2) dozen bottles (soft drink size), and two (2) cubic yards of varying size rock as specified above. During the test some solids of not less than four (4) inches in diameter shall be picked up. During the tests the pick-up tube shall be submerged and at times it shall be allowed to "slurp." During each method of pick-up the suction system shall continue to operate without losing suction. The suction shall be measured at the standard location used by the supplier on their commercial equipment, the meter may read in either inches of water or inches of mercury. In either case, it shall be standard for the type of machine supplied. This test can be performed at the same time as 4.3.1.

4.4.3 Road test. Position the sections of suction tube hose and accessories in their respective stowage positions. Drive the vehicle over paved roads, which include 90° left and right turns, for a distance not less than 25 miles at speeds up to 45 mph. Drive the loaded vehicles for a minimum distance of 15

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miles over unimproved roads at speeds up to 10 mph. All lights (directional signal, hazard, license plate and stop) shall be operated at least five (5) times during these tests. During each portion of the road test five (5) sudden stops shall be made. The fully loaded vehicle shall be subjected to three (3) emergency stops at speeds of 20 mph on clean dry pavement. The truck shall stop within 30 feet from the point where the brakes were applied. During all portions of the road test the vehicle shall demonstrate satisfactory performance and roadability.

4.4.4 Vehicle weight. First production vehicle shall be weighed to determine curb and loaded weight and distribution of curb and loaded weight on front and rear axle. The imposed loading on front and rear axle will be computed using the curb weight and the payload to provide the GVW. Calculated imposed loads on front and rear axle will be utilized to ascertain that the suspension, axles and tires furnished are of adequate capacity to meet contract requirements.

4.4.5 Production sample. Upon acceptance of the first production vehicle, it shall remain at the manufacturing facility as a production sample and be the last vehicle shipped on the contract. The contractor shall maintain the vehicle in a serviceable condition for the duration of the contract.

4.4.6 Failure. Failure of the first production vehicle to meet requirements of the contract shall be cause for the Government to refuse acceptance of all vehicles under the contract until corrective action has been taken.

5. PACKAGING

5.1 Vehicle processing. Vehicle shall be processed for shipment from manufacturer's plant to initial receiving activity in accordance with the terms of the contract.

6. NOTES

6.1 Intended use. The vehicles covered by this specification are intended for general preventative maintenance cleaning of sewers and storm drains with water at high pressure. The vehicles can be used to clear clogged sewers and storm drains, vacuum cleaning manholes and catch basins, and pumping septic tanks.

6.2 Ordering data. Procurement documents should specify the following:

- a. Title, number and date of this specification.
- b. Winterization (see 3.4.1.5).
- c. Tools (see 3.4.16.2).
- d. Spray bar, when required (see 3.5.2.13).
- e. Paint color, when specified the cleaning, treatment, and finish painting shall be dark green, color chip number 24052 of FED-STD-595, and in accordance with MIL-STD-1223 (see 3.1.1.1).
- f. Rustproofing, undercoating and wood treatment (see 3.1.1.3, 3.1.1.4, and 3.1.1.7).
- g. A carrier, if required (see 3.4.10.3).
- h. A spare wheel or rim, if required (see 3.4.10.4).

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i. Spare tire assembly, if required (see 3.4.10.5).

6.3 Subject term (key word) listing.

- a. Truck, sewer cleaning
- b. Engine, gasoline auxiliary
- c. Tank, water
- d. Pump, centrifugal
- e. Pump, vacuum

Custodian:
Air Force - 99

Preparing Activity:
Air Force - 84

Agent: Air Force - 99
Project Number:
2320-F404

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER MIL-T-87980	2. DOCUMENT TITLE Truck, Sewer and Pipe Cleaner, High Pressure Water Jet Type,...
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3a. NAME OF SUBMITTING ORGANIZATION

4. TYPE OF ORGANIZATION *(Mark one)*

VENDOR

USER

MANUFACTURER

OTHER *(Specify):* _____

b. ADDRESS *(Street, City, State, ZIP Code)*

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* - Optional

b. WORK TELEPHONE NUMBER *(Include Area Code)* - Optional

c. MAILING ADDRESS *(Street, City, State, ZIP Code)* - Optional

8. DATE OF SUBMISSION (YYMMDD)

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)